United States Patent [19]

Suzuki et al.

[11] **4,270,472**

[45] **Jun. 2, 1981**

[54] **INDICATION ARRANGEMENT FOR USE IN A SEWING MACHINE**

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[21] Appl. No.: **47,707**

[22] Filed: **Jun. 12, 1979**

[30] **Foreign Application Priority Data**

Jun. 13, 1978 [JP] Japan 53-71714

[51] **Int. Cl.**[3] **D05B 79/00**; D05B 3/02

[52] **U.S. Cl.** ..... **112/158 E**; 112/158 F; 112/158 A

[58] **Field of Search** ..... 112/158 A, 158 D, 158 E, 112/158 F, 158 R

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Attorney, Agent, or Firm—Birch, Stewart, Kolasch & Birch

[57] **ABSTRACT**

A zigzag sewing machine of a sewing pattern selectable type is disclosed having a cloth advancing mechanism for advancing a cloth at a predetermined pitch after every one stitch and a pitch control dial for controlling the length of said pitch. A plurality of indication lamps are disposed around the control dial for indicating an available range for the selected sewing pattern.

11 Claims, 6 Drawing Figures

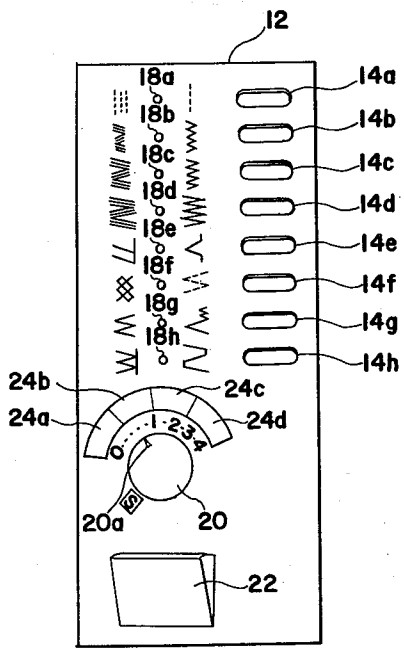
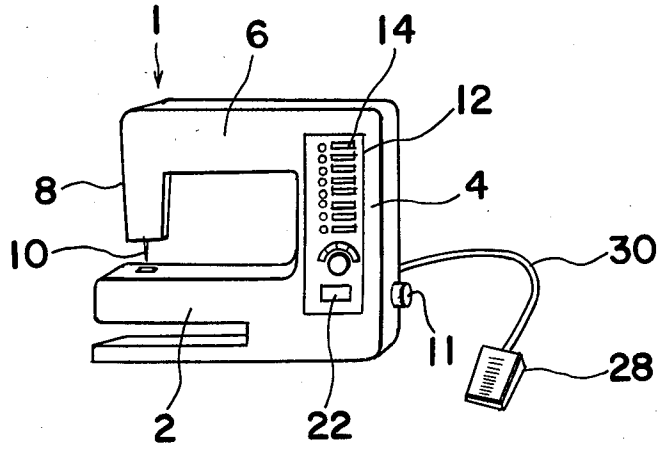


Fig. 1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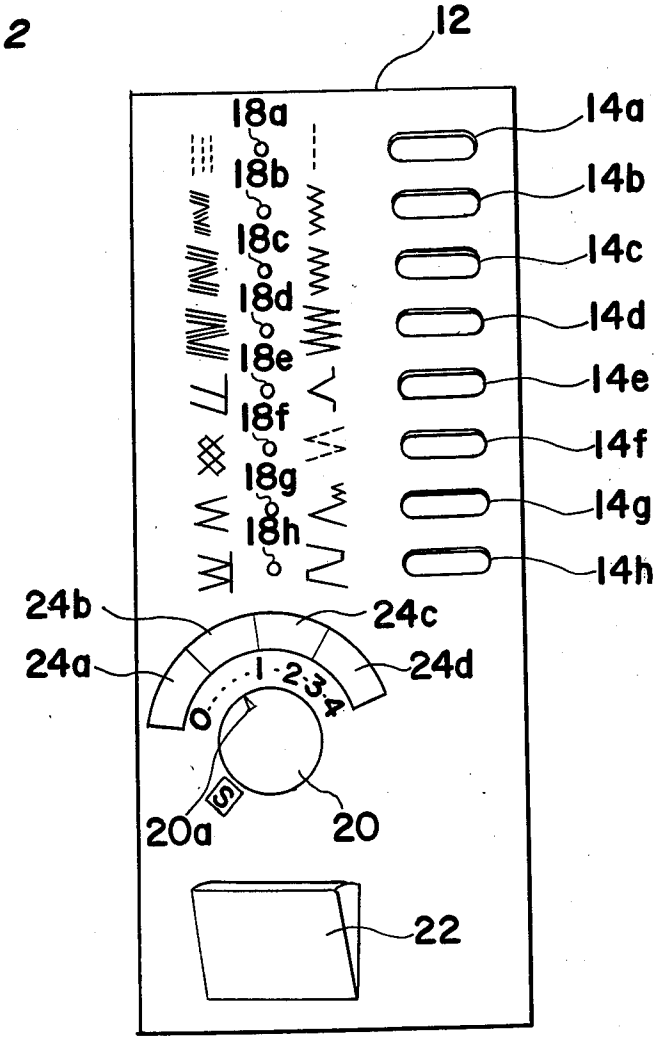
22

Fig. 2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18g
18h
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14d
14e
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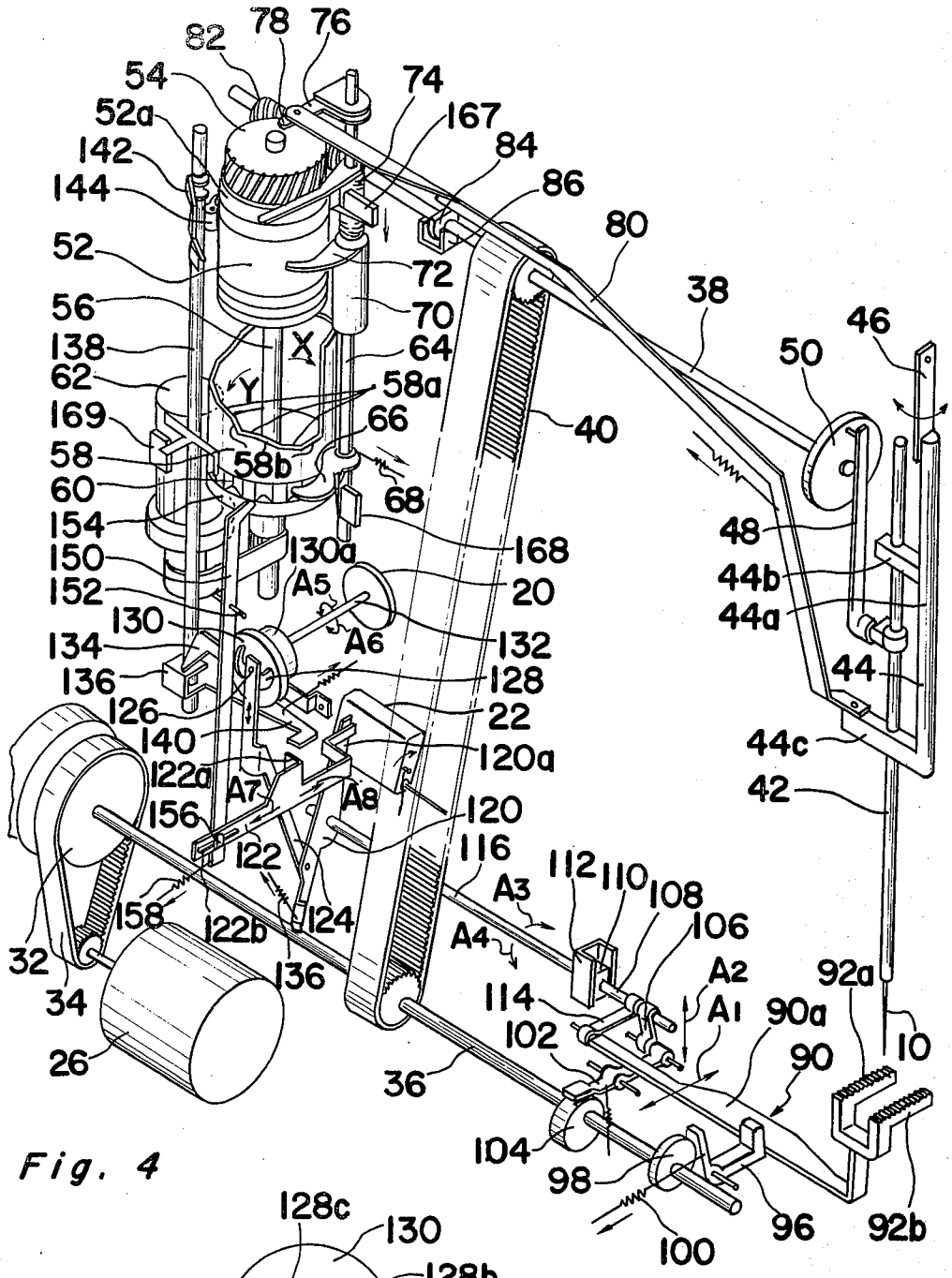
14g
14h
24b
24c
24a
24d
0
1
2
3
4
S
20a
20
22

Fig. 3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52a
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144
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138
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50
62
Y
58a
169
66
40
58
58b
60
68
48
154
168
150
130a
44b
152
A5
20
44a
130
A6
132
134
44
136
128
126
22
140
120a
44c
122a
A7
A8
42
156
120
116
122
112
110
108
A3
158
106
124
122b
A4
32
A2
92a
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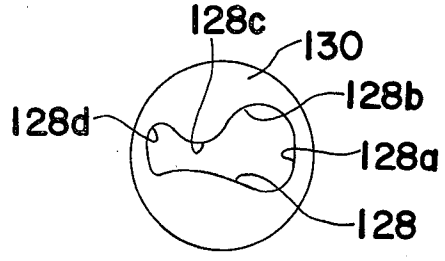
A1
34
90a
102
10
26
90
36
104
98
96
92b
100

Fig. 4


128c
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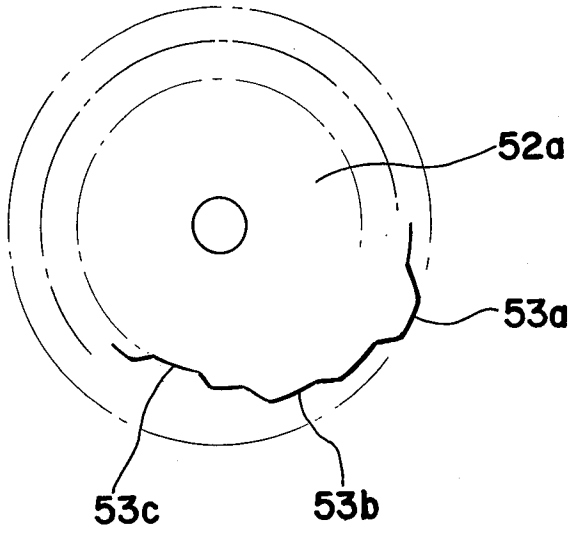
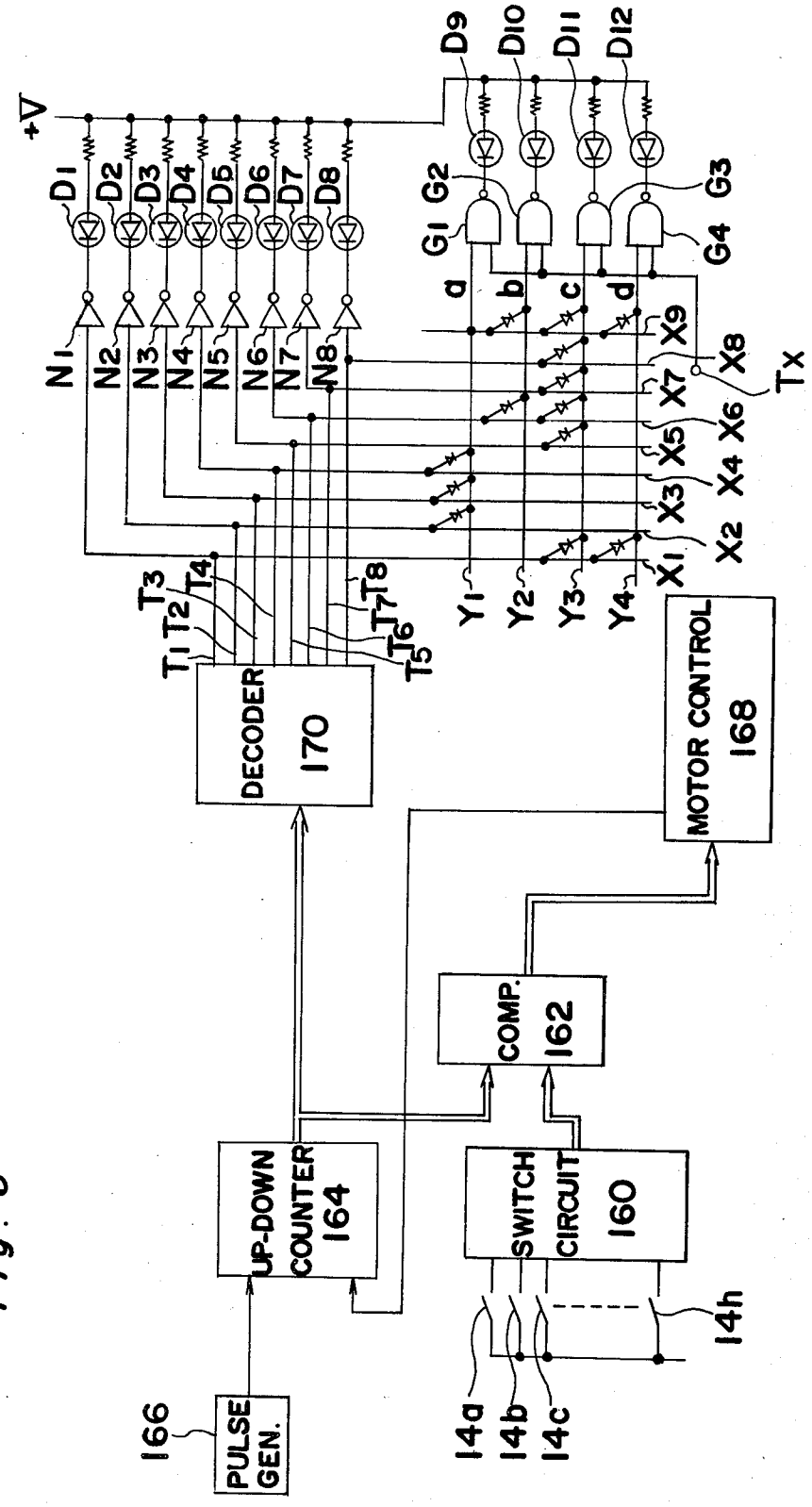
128b
128d
128a
128

Fig. 5

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D1
D2
D3
D4
D5
D6
D7
D8
D9
D10
D11
D12
G1
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G3
G4
a
b
c
d
N1
N2
N3
N4
N5
N6
N7
N8
X9
X8
X7
X6
X5
X4
X3
X2
X1
Tx
Y1
Y2
Y3
Y4
T1
T2
T3
T4
T5
T6
T7
T8
DECODER 170
MOTOR CONTROL 168
COMP. 162
UP-DOWN COUNTER 164
SWITCH CIRCUIT 160
PULSE GEN.
166
14a
14b
14c
14h

Fig. 6

INDICATION ARRANGEMENT FOR USE IN A SEWING MACHINE

BACKGROUND OF THE INVENTION

The present invention relates to an electric sewing machine and, more particularly, to an indication arrangement for use in the sewing machine for indicating a range of pitch of a cloth advance suited for the selected zig-zag pattern.

Recently, there have been proposed various types of electrically operated sewing machines which provide a number of patterns of zig-zag sewing. The patterns are basically determined by two factors which are: the lateral movement of the thread carrying needle; and the pitch of advance or retreat of the cloth effected between the two succeeding stitches. The first factor, that is, the lateral needle movement, is generally controlled by a cam which is selected from a number of different cams, while the second factor, that is, the pitch of advance of the cloth, is controlled by a suitable pitch adjusting means such as a dial incorporated in the sewing machine. In order to reproduce a prearranged pattern, it is necessary to select a proper cam and also to set the dial to a position which provides a proper pitch of advance of the cloth.

In the conventional sewing machine, the pitch control dial has an index marking which is, as the dial is turned, selectively brought in register with numerical markings scaled adjacent and around the dial. These markings, however, only assist the operator to understand the pitch of cloth advance with respect to the registered numerical marking. Therefore, in such conventional sewing machines, it is necessary for the operator to make several trials of sewing before the sewing pitch control dial is set to an optimum position, or otherwise the dial has to be set empirically by the operator.

Although there have been proposed a pitch control dial with a plurality of concentric bars indicating an available range for the different cams, this arrangement needs time to find one bar corresponding to the selected cam. Furthermore, the number of the bars becomes larger as the cams are increased.

SUMMARY OF THE INVENTION

Accordingly, it is a primary object of the present invention to provide a sewing machine having an indication means for indicating a proper pitch of stitches for each of the cams.

In accomplishing these and other objects, a sewing machine having a thread carrying needle which is reciprocated in an axial direction thereof and is jogged in a lateral direction, a clath advancing mechanism for advancing a cloth in a direction perpendicular to the lateral direction at a predetermined pitch every after one stitch for forming a predetermined pattern of stitches, comprises, according to the present invention, a plurality of individual pattern information carrying means each provided for controlling the lateral movement of the thread carrying needle, means for selecting any one of the pattern information carrying means, means for producing a signal indicative of the selected pattern information carrying means, means for adjusting the pitch of cloth advance, and a plurality of illumination elements aligned along the pitch adjusting means. The sewing machine further comprises, according to the present invention, a circuit means connected between the signal producing means and the illumination elements for lighting at least one predetermined illumination element upon receipt of the selected signal so as to indicate an available range of the pitch for the selected pattern information carrying means by the lighted illumination element.

BRIEF DESCRIPTION OF THE DRAWINGS

These and other objects and features of the present invention will become apparent from the following description taken in conjunction with a preferred embodiment thereof with reference to the accompanying drawings, in which:

FIG. **1** is a perspective view of a sewing machine according to the present invention;

FIG. **2** is a fragmentary view of a control panel provided in a frame of the sewing machine;

FIG. **3** is a schematic view of a needle actuating mechanism and a cloth moving mechanism which are incorporated in the sewing machine shown in FIG. **1**;

FIG. **4** is a plan view of a disc shown in FIG. **3**;

FIG. **5** is a plan view of a cam for controlling the cloth movement; and

FIG. **6** is a circuit diagram, partly shown in blocks, incorporated in the sewing machine.

DETAILED DESCRIPTION OF THE INVENTION

Before the description of the present invention proceeds, it is to be noted that like parts are designated by like reference numerals throughout the accompanying drawings.

Referring to FIG. **1**, a sewing machine **1** includes a bed **2** from which rises a standard **4** supporting a bracket arm **6** overhanging the bed **2**. The arm **6** supports a head **8** which has a needle **10** projecting outwardly and downwardly towards the bed **2**. Disposed on the front surface of the standard **4** is control panel **12**, as best shown in FIG. **2**, including a plurality of, for example, eight buttons **14***a* to **14***h*, eight indication lamps **18***a* to **18***h* for the selected buttons **14***a* to **14***h*, respectively, a sewing pitch control dial **20** and a button **22** for effecting a retreat movement of the cloth. The sewing pitch control dial **20** has an index arrow **20***a* which is, as the dial **20** is rotated, selectively brought in register with character S and numerical markings scaled adjacent to and around the dial **20**. When the arrow **20***a* points "0", the cloth under the needle **10** is held standstill so that the needle **10** can carry out the sewing repeatedly on the same place of the cloth. Upon rotation of the dial **20** to bring the index arrow **20***a* in register with one of the numerical markings, the cloth is advanced in a predetermined sewing pitch determined by the position of the dial **20** so rotated. The sewing pitch is greater as the weight of the numerical markings increases. When the dial **20** is rotated to a position S, the sewing pitch is controlled to cause the cloth to advance at a varying pitch. Indication lamps **24***a*, **24***b*, **24***c* and **24***d* in a shape of an arcade are provided around the dial **20** adjacent the numerical markings so that each indication lamp may indicate a predetermined range in the numerical markings. For example, the indication lamp **24***a*, **24***b*, **24***c* and **24***d* cover the numerical range 0 to 0.5, 0.5 to 1, 1 to 2.5 and 2.5 to 4, respectively. Each time the sewing pattern is selected by pushing one of the buttons **14***a* to **14***h*, one or more indication lamp **24***a* to **24***d* is lit to indicate a range of pitch suited for the selected pattern.

Two groups of sewing patterns are shown one on each side of a column of the indication lamps 18*a* to 18*h*. The sewing patterns of one group shown on the right-hand side of the respective lamps 18*a* to 18*h* are obtained when the arrow 20*a* is in register with one of the numerical markings whereas the sewing patterns of the other group shown on the left-hand side of the respective lamps 18*a* to 18*h* are obtained when the arrow 20*a* is in register with the character S.

Referring to FIG. 3, there is shown a mechanism of the sewing machine 1. The mechanism can be briefly divided into first and second sections, the first section being a needle actuating mechanism while the second section is cloth moving mechanism. Each of such mechanism is actuated by a motor 26 which is controlled by a foot-switch 28 connected to the machine 1 through a cable 30, as shown in FIG. 1. The rotation of the motor 26 is transmitted to a fly-wheel 32 through an endless belt 34. The fly-wheel 32 is rigidly mounted on a shaft 36 which is in common with a main shaft for the cloth moving mechanism. This shaft 36 is connected to another shaft 38 for the needle actuating mechanism through an endless belt 40 so that the shafts 36 and 38 can be rotated simultaneously with each other during rotation of the motor 26. Each mechanism is described in detail hereinbelow.

Needle Actuating Mechanism

The thread carrying needle 10 is affixed to a needle bar 42 which is slidably supported by an F-shaped framework 44 having an up-right bar 44*a* and two parallel bars 44*b* and 44*c* extending laterally from the bar 44*a*. The needle bar 42 is slidably inserted through holes formed in the bars 44*b* and 44*c*. A rectangular spring plate 46 has one end connected to the upper end of the up-right bar 44*a* and the other end connected to the frame of the sewing machine, whereby the F-shaped framework can undergo a swinging motion. At an intermediate portion between the bars 44*b* and 44*c*, the needle bar 42 is tightly held by a link 48 which is connected to a crank 50 mounted on the shaft 38. Therefore, the rotation of the shaft 38 is converted into the reciprocal movement of the needle bar 42 by the crank 50. The lateral jogging movement of the needle 10 can be obtained by the swing motion of the F-shaped framework 44. This swing motion is controlled by a cam mechanism.

The cam mechanism includes a plurality of cams 52 placed one above the other and rigidly connected to each other. Such cam arrangement 52 is also rigidly connected to a spur gear 54 and is rotatably mounted on a shaft 56 so that the gear 54 rotates together with the cam arrangement freely about the shaft 56. A rod 64 having a rectangular cross section is provided adjacent the cam arrangement 52 with it opposite ends rotatably journalled to the frame of the sewing machine. Mounted on the rod 64 is a cylindrical arm carrier 70 which slidably displaces along the rod 64. A step-formed drum 58 is rigidly mounted on the shaft 56 while a timing cam 60 is also rigidly mounted on the shaft 56. Since an upper annular end of the drum 58 is formed with a generally helical cam face composed of a plurality of steps 58*a* and a corresponding number of slopes 58*b* each positioned between every adjacent two of the steps 58*a*, the arm carrier 70 having its lower end resting on the upper annular end face of the drum descends or elevates along the rod 64 as the drum 58 is rotated in a direction as shown by the arrow X or in a direction as shown by the arrow Y, respectively, about the shaft 56 by a motor 62 connected to the shaft 56. The step-formed drum 58 is provided for supporting the cylindrical arm carrier 70 at a desired level. The position of the drum 58 shown in FIG. 3 supports the carrier 70 at the highest level. Upon rotation of the drum 58 in the direction X by the actuation of the motor 62, the carrier 70 is gradually lowered.

An arm 66 is mounted on the rod 64 at a position adjacent the timing cam 60 by means of a clicking clutch means (not shown), said clicking clutch means being so designed as to enable the arm 66 to rotate clockwise about and independently of the rod 64 and also to rotate counterclockwise together with the rod 64. A free end of the arm 66 remote from the rod 64 is engaged to the timing cam 60.

A spring 68 is connected to the arm 66 to bias the arm 66 and the rod 64 to rotate in a clockwise direction when viewed from top. The cylindrical shaped arm carrier 70 is slidably mounted on the rod 64 and carries an arm or cam follower 72 also mounted on the rod 64. A coil spring 74 mounted on the rod 64 biases the arm 72 and the arm carrier 70 downwardly with a bottom end of the arm carrier 70 held in contact with a stepped upper edge of the drum 58. Since the upper edge of the drum 58 is provided with steps 58*a* and slopes 58*b*, the rotation of the drum 58 moves the carrier 70 along the rod 64 to vary the level of the carrier 70. When the carrier 70 is slid along the slope 58*b* defined between every two neighboring steps 58*a* in the drum 58 for changing the level thereof, the arm 66 slides over a corresponding projecting portion of the timing cam 60. Thus, the arm 66 is pivoted by the rotation of the shaft 64 in a counterclockwise direction. In other words, during the movement of the carrier 70 along the rod 64 with its lower end sliding in contact with any one of the slopes 58*b* in the drum, a free end of the arm 66 slides over a corresponding one of the projections of the timing cam 60. Therefore, during the displacement of the arm 72 in the vertical direction, the arm 72 is disengaged from the cam arrangement 52.

On the other hand, when the carrier 70 is in contact with a flat edge or step 58*a* of the drum 58, the arm 66 is positioned in a recess defined between the two neighboring projections of the timing cam 60 and, hence, the arm 72 is held in contact with one of the cams in the cam arrangement 52. Rigidly mounted at upper portion of the shaft 64 is a disc plate 76 having a projection 78. This projection 78 is pivotally connected to a bar member 80 which extends to the bar 44*c* of the F-shaped framework 44. A worm gear 82 is mounted on the shaft 38 and is engaged to the spur gear 54 so that the rotation of the shaft 38 during the sewing operation is transmitted through the spur gear 54 to the cam arrangement 52.

The operation of the needle actuating mechanism is described hereinbelow.

Upon one rotation of the shaft 38, the needle 10 undergoes one reciprocation. Also the rotation of the shaft 38 causes the rotation of the cam arrangement 52 through the engagement between the worm gear 82 and the spur gear 54. The rotation of the cam arrangement 52 causes a jogging movement of the cam follower 72 by following projection lobes or recessed stations and, thus, the projection 78 is jogged accordingly. This jogging movement is transmitted to the F-shaped framework 44 through the bar member 80 to swing the needle 10 laterally. Thus, the zig-zag sewing can be effected according to a pattern determined by the selected cam

in the cam arrangement **52** to which the arm **72** is then engaged. When it is necessary to change the cam, that is, to change the level of the arm **72**, the motor **62** is turned on by a suitable switch means such as the one electrically coupled to the buttons **14***a* to **14***h* in a manner as will be described in detail later with reference to FIG. **6**. When the motor **62** is so turned on, the shaft **56** is rotated to rotate the drum **58** and the timing cam **60**. The rotation of the timing cam **60** causes the arm **66** to jog accordingly while the rotation of the drum **58** moves the cam follower **72** up or down together with the carrier **70** along the shaft **64**. Since the vertical displacement of the cam follower **72** is caried out during the movement of the arm **66** over the projecting portion of the timing cam **60**, the cam follower **72** is held clear of the cam arrangement **52**.

Cloth Moving Mechanism

A rack member **90** having a pair of saw tooth edges **92***a* and **92***b* and an elongated bar portion **90***a* is movably accommodated in the bed **2** of the sewing machine **1**. An L-shape block **96** journalled to the frame of the sewing machine has one end portion held in contact with one side edge of the bar portion **90***a* while the other end portion thereof is held in contact with a disc **98** which is eccentrically rigidly mounted on the shaft **36**. The L-shaped block **96** is normally biased in one direction by a spring **100** with said other end portion thereof held in contact with the disc **98**. Upon rotation of the shaft **36**, the L-shaped block **96** is rocked to provide a lateral movement force to the rack member **90** in a direction as indicated by the arrow A1 in FIG. **3**.

An elongated seesaw plate **102** pivotally supported at its substantially intermediate portion by a pin is provided adjacent the L-shaped block **96**. This plate **102** has one end overlaying and engaged to a peripheral face of a disc **104** which is eccentrically rigidly mounted on the shaft **36**. The other end portion of the plate **102** is hingedly connected to one end of an arm **106**. The other end of the arm **106** is also hinged to a bar **108** which extends from a cubic block **110** slidably accommodated in a casing **112** of a substantially U-shaped cross section. The end of the bar portion **90***a* of the rack member **90** remote from the saw tooth edges **92***a* and **92***b* is hinged to one end of an arm **114** while the other end of the arm **114** is also hinged to the bar **108**. In this construction, during the rotation of the shaft **36**, the plate **102** undergoes a seesaw motion to move the bar **108** vertically in a direction as indicated by the arrow A2 in FIG. **3**.

When the groove in the casing **112** is vertically oriented such as shown in FIG. **3**, the bar **108** vertically moves as the cubic block **110** reciprocates in the groove of the casing **112**. In this case, the rack member **90** is moved only in a vertical direction A2. Therefore, the cloth positioned above the saw tooth edges is held standstill. When the groove in the casing **112** is slanted in one direction as a result of rotation of a shaft **116** connected to the casing **112** in a direction as indicated by an arrow A3, the cubic block **110** reciprocates accordingly along the groove in the casing **112**. In this case, the rack member **90** undergoes such a motion that an end portion of the bar portion **90***a* of the rack member **90** adjacent the toothed edges **92***a* and **92***b* describes an oval orbit in a counterclockwise direction, when viewed from the right-hand end, whereby the cloth is advanced. The pitch of advance is controlled by the setting of the sewing pitch control dial **20** which determines the angle through which the casing **112** reciprocatingly rotates together with the shaft **116**.

On the other hand, when the groove in the casing **112** is slanted in the other direction as a result of rotation of the shaft **116** in a direction as indicated by the arrow A4, the cubic block **110** reciprocates accordingly along the groove for causing the rack member **90** to move following a similar oval orbit in a clockwise direction when view from the right-hand end. In this case, the cloth is retreated. The manner in which the rotation of the shaft **116** is controlled is described hereinbelow.

An elongated plate **120** is rigidly connected to the end of the shaft **116** remote from the casing **112**. One end portion **120***a* of the plate **120** is pivotally connected to a plate **122**, so that the plate **122** moves laterally as a result of rotation of the plate **120**. The other end portion of the plate **120** is pivotally connected to a plate **124** which has a pin projection **126** at the end thereof remote from the plate **120**. This pin projection **126** is engaged to an edge of a detent recess **128** formed in a disc plate **130**. The recess **128** as best shown in FIG. **4** has a predetermined pattern defined by portions **128***a*, **128***b*, **128***c* and **128***d*. The disc **130** is eccentrically connected to a shaft **132** which in turn is connected to the dial **20** described above. Since the plate **120** is biased by a spring **136** about the shaft **116** in a clockwise direction when viewed from right, the pin projection **126** is held in contact with an upper edge of the detent recess **128**. When the disc **130** is held in a position as shown in FIG. **3**, the edge portion **128***b* of the recess **128** is held in contact with the pin projection **126**. It is to be noted that the engagement of the pin projection **126** at the portion **128***b* brings the casing **112** in a position with the groove thereof oriented in a vertical direction as shown. At this time, the dial **20** is in position with the arrow **20***a* held in register with the "0" marking. Upon rotation of the disc **130** in a direction A5, the pin projection **126** comes into contact with the portion **128***a* of the recess **128**. Therefore, the plate **124** is raised upwardly to allow rotation of the shaft **116** in the direction A3. Thus, the casing **112** is slanted to effect the orbitary movement of the rack member **90** in such a manner as to advance the cloth. At this time, the dial **20** is in position with the arrow **20***a* held in register with one of the numeral markings.

The disc **130** is coupled with an auxiliary disc **130***a* having a smaller diameter than that of the disc **130**. This auxiliary disc **130***a* is also eccentrically connected to the shaft **132**. Provided under the auxiliary disc **130***a* is an arm **134** having one end portion pivotally connected to the frame of the sewing machine while the other end is held in contact with a platform **136** slidably mounted on a shaft **138** extending in parallel to the shaft **56**. An arm **140** extends from the platform **136** with the free end thereof normally terminating adjacent and above a face **122***a* formed in the plate **122**. Since the arm **140** is rigidly connected to the shaft **138**, the rotation of the arm shaft **140** accordingly results in rotation of the arm **140**. Another arm **142** is also rigidly mounted on the shaft **138** at upper portion thereof. This arm **142** is held in contact with a hinged V-shaped block **144** which is in turn held in contact with the uppermost cam **52***a* in the cam arrangement **52**. The uppermost cam **52***a* is provided for controlling the cloth movement. The rotation of the cam arrangement **52** results in a jogging motion of the V-shaped block **144** and also the arm **142**. Therefore, the shaft **138** is rotated. This rotation of the shaft **138** is transmitted to the arm **140**. Normally, since the arm **140** is free from any element, the rotation or jog-

ging movement of the arm **140** is not transmitted to further element. When the dial **20** is turned to a direction A6, however, the recess **128** is rotated to push down the plate **124** as the pin projection **126** slides along the portion **128***c*. Therefore, the plate **122** is forcibly pushed to a direction A7. The further rotation of the dial **20** in the direction A6 pushes down the arm **134** by the auxiliary disc **130***a*, so that the platform **136** is pushed down to lower the arm **140**. Thereafter, the pin projection **126** slides into the portion **128***d* to substantially raise the plate **124** for moving the plate **122** towards the direction A8. As a consequence, the face **122***a* of the plate **122** comes into contact with the free end of the arm **140**. It is to be noted that this is effected as the dial **20** is brought to a position with the arrow **20***a* registered with the "S" marking. The establishment of such connection between the arm **140** and the face **122***a* transmits the jogging movment of the arm **140** through the plates **122** and **120** to the shaft **116**, so that the casing **112** is slanted in the direction A3 or A4 with respect to the jogging of the arm **140**. Thus, the movement of the cloth is varied.

Referring to FIG. **5**, there is shown one example of the cloth moving cam **52***a* having a most projecting portion **53***a*, normal level portion **53***b* and a recessed portion **53***c*. When the V-shaped block **144** slides over the projecting portion **53***a*, the shaft **116** is turned to the direction A4 to retreat the cloth. When the V-shaped block **144** slides over the normal level portion **53***b*, the shaft **116** is held in such a position as to maintain the casing **112** vertically as shown in FIG. **3**, and when the V-shaped block **144** slides over the recessed portion **53***c*, the shaft **116** is turned to the direction A3 for advancing the cloth.

An elongated plate **150** is pivotally supported by a pin **152** with upper end thereof held in contact with a cam **154** positioned under the timing cam **60** and rigidly mounted on the shaft **56**. The other end of the plate **150** is provided with a pin projection **156** which is slidably accommodated in an elongated groove **122***b* formed in the plate **122**. A spring **158** is provided for urging the upper end of the plate **150** to the cam **154**. Since the biasing force of the spring **158** is larger than that of the spring **136**, the movement of the plate **122** particularly in the direction A8 is restricted by the plate **150**. In other words, the pin projection **156** limits the lateral movement of the plate **122** within a distance defined by the effective length of the groove **122***b* between the pin projection **156** and the left end of the groove **122***b*. For example, when carrying out a straight stitch, the upper end of the plate **150** will be held in contact with the most projecting portion of the cam **154** so that the effective length of the groove **122***b* between the pin projection **156** and the left end of the groove **122***b* will be considerably large. Thus, upon rotation of the dial **20** to a large numbered position, the shaft **116** can be turned to the direction A3 through a large angle. In other words, stitching is effected at an interval of a relatively large pitch while the cloth is advanced. By all means, it is possible to advance the cloth with a small pitch for this straight stitch by simply turning the dial **20** to a smaller number. On the other hand, when carrying out a button hole stitch, it is necessary to stitch the same place repeatedly. In this case, the upper end of the plate **150** will be held in contact with the most detent portion of the cam **154** so that the effective length of the groove **122***b* between the pin projection **156** and the left end of the groove **122***b* will be zero. Therefore, the plate **122** will not be moved to the direction A8 so as to incline the casing **112** in the direction A3, regardless of turning of the dial **20**.

The button **22** is positioned adjacent the upper end of the plate **120** for allowing, when the button **22** is pushed, the shaft **116** to rotate in the direction A4. Thus, the retreat movement of the cloth can be effected during the pushing of the button **22**.

Referring to FIG. **6**, there is shown a block diagram of a control circuit for controlling the mechanism described above. The control circuit includes a switching circuit **160** which produces a binary coded decimal (BCD) signal upon receipt of high level signal from one of the push button switches **14***a* to **14***h* described above. For example, when the first button switch **14***a* is turned on, BCD signal indicative of "1" is produced from the switch circuit **160**. Similarly, when the second button switch **14***b* is turned on, BCD signal indicative of "2" is produced, and so on. Such BCD signal from the circuit **160** is applied to a comparator **162** in which the BCD signal is compared with a similar BCD signal from an up-down counter **164**. The up-down counter **164** counts up or down each time a pulse signal is applied thereto from a pulse generator **166**. The pulse generator **166** is constituted by a reed switch **168** (FIG. **3**) positioned closely adjacent the arm **66**. The reed switch **168** is turned on when the arm **66** is pushed in a counterclockwise direction by the contact between the arm **66** and the projecting portion of the timing cam **60**. Since the projecting portion of the timing cam **60** pushes the arm **66** each time the arm **72** is shifted one step higher or lower from the present position, the pulse from the pulse generator **166** indicates a step change in the cam selection. Therefore, the up-down counter **164** produces the BCD signal indicative of the position of the arm **72** with respect to the cam arrangement **52**. For example, when the arm **72** is positioned in alignment with the uppermost cam, the up-down counter **164** produces the BCD signal indicative of "1". Thereafter, if the arm **72** is moved to the second cam from the uppermost one, the pulse generator **166** generates a pulse to count up the contents of the counter **164** from "1" to "2". Therefore, at the moment when the arm **72** is positioned in alignment with the second cam from the uppermost one, the up-down counter **164** produces the BCD signal indicative of "2". Whether the pulse from the pulse generator **166** is to be counted up or down in the counter **164** is determined by a signal obtained from a motor control **168**. When the motor control **168** controls the motor **62** to rotate in one direction, counting up is effected in the counter **164**. On the other hand, when the motor control **168** controls the motor **62** to rotate in the other direction, counting down is effected in the counter **164**. The difference in value in the BCD signal between that from the switch circuit **160** and that from the up-down counter **164** is applied to the motor control **168**. When the difference is positive, that is, when the BCD signal from the switch circuit **160** is larger than that from the up-down counter **164**, the motor control **168** controls the motor **62** to rotate in said one direction. On the other hand, when the difference is negative, that is, when the BCD signal from the switch circuit **160** is smaller than that from the up-down counter **164**, the motor control **168** controls the motor **62** to rotate in said other direction. By all means, when the BCD signals from the switch circuit **160** and from the up-down counter are equal, the comparator **162**

produces zero level signal to maintain the motor **168** in an inoperative condition.

After the motor control **168** is actuated to position the arm **72** to such required position as selected by the pushing of one of the button switches **14***a* to **14***h*, the up-down counter **164** produces the BCD signal indicative of the position of the arm **72**. This BCD signal from the up-down counter **164** is applied to a decoder **170** having eight output terminals T1 to T8. For example, when the BCD signal from the up-down counter **164** is indicative of numeral "3", a high level signal is produced from the terminal T3 of the decoder **170**. In general, the decoder **170** produces a high level signal from one of the terminals T1 to T8 which corresponds to the BCD signal obtained from the up-down counter **164**.

The output terminals T1 to T8 are, respectively, connected through inverters N1 to N8 to light emitting diodes D1 to D8. Each of the diodes D1 to D8 is in turn connected through a suitable resistor to a common source of electric power +V. It is to be noted that the diodes D1 to D8 correspond to the indication lamps **18***a* to **18***h*, respectively, shown in FIG. 2.

In addition to above, the output terminals T1 to T8 are also connected, respectively, to lines X1 to X8 which are aligned in a column. These lines X1 to X8 constitute a network presented in a form of matrix together with four lines Y1 to Y4 which are aligned in a row. A diode is connected at the intersection between the lines X1 and Y3 in a forward biased direction from the line X1 to the line Y3. In a similar manner, a diode is connected at the intersections between the lines X1 and Y4, lines X2 and Y1, lines X3 and Y1, lines X4 and Y1, lines X5 and Y3, lines X6 and Y2, lines X6 and Y3, lines X7 and Y3, and lines X8 and Y3. The matrix circuit further includes another line X9 in the column which is connected to the line Y1. A diode is further provided at the intersections between the lines X9 and Y2, lines X9 and Y3, and lines X9 and Y4. The lines Y1 to Y4 are connected, respectively, to one input of NAND gates G1 to G4 and, in turn, to light emitting diodes D9 to D12. Each of the diodes D9 to D12 is connected through a suitable resistor to the common source of electric power +V. It is to be noted that these diodes D9 to D12 correspond to the indication lamps **24***a* to **24***d*, respectively, shown in FIG. 2. The other input of each NAND gate is connected to a terminal Tx which is normally held high during the time the control circuit is turned on. When it is not required to adjust pitch of the stitches, a low level signal is applied to terminal Tx to prohibit the actuation of diodes D9–D12. The operation of the control circuit is described hereinbelow.

Assuming that the arm **72** is now in engagement with the third cam from the uppermost cam in the cam arrangement **52**, the up-down counter **164** produces BCD signal indicative of "3", thus the decoder **170** produces a high level signal from the terminal T3. This high level signal is applied to the inverter N3 so that the light emitting diode D3 can be lit. In addition, the high level signal from the terminal T3 is also applied to the line X3 for applying the high level signal to the line Y1 and also through the line X9 to the lines Y2, Y3 and Y4. Therefore, the NAND gates G1 to G4 are actuated to light all the diodes D9 to D12.

In the above described case, it is indicated that, for sewing a given pattern of stitches represented by the third cam, the pitch control dial **20** may be adjusted to any desired position shown by the numerical markings "0" to "4".

In the next step, if the seventh button **14***g* from the top is pushed, the switch circuit **160** produces a BCD signal indicative of a numeral "7". This BCD signal of "7" is compared with the BCD signal from the up-down counter **164**. Since the arm **72** is now in contact with the third cam as described above, the counter **164** provides BCD signal of "3" to the comparator **162**. The result of the comparison is that the BCD signal from the switch circuit **160** is greater by "4" than the BCD signal from the counter **164**. Therefore, the motor control **168** actuates the motor **62** to revolute in one direction to lower the level of the arm **72**. During the descent of the arm **72**, the pulse is applied to the counter **164** to count up the number until the number coincides with the number from the switch circuit **160**, that is, "7". When the number from the counter **164** coincides with the number from the switch circuit **160**, the motor control **168** stops the motor **62** to complete the step. Therefore, the decoder **170** produces a high level signal from the terminal T7 for illuminating the diode D7 and for illuminating the diode D11. In this case, it is indicated that, for sewing of a given pattern of stitches represented by the seventh cam, the pitch control dial **20** should be adjusted to any one of the positions shown by the numerical markings "1" to "2.5".

It is to be noted that this indication of pitch range does not mean that the sewing machine **1** only operates within said range, but means that the pattern of a reasonable shape can be obtained when the dial **20** is so turned as to bring the index arrow **20***a* in register with the numerical markings ranging from "1" to "2.5".

It is also to be noted that during the actuation of the motor **62**, the content of the counter **164** is sequentially counted up from "3" to "7" so that the output from the decoder **170** can produce a high level signal sequentially from the terminal T3 to the terminal T7.

It is further to be noted that the diodes employed in the matrix circuit can be distributed in other crossing points than the points described above for changing the combination of lighting the light emitting diodes D9 to D12 in the consideration of the type and/or number of cams employed in the cam arrangement **52**.

Since the sewing machine according to the present invention indicates the available range for the pitch of switches, the operator can easily reproduce the stitch pattern by turning the dial **20** to bring the index arrow **20***a* in register with a numerical marking in the indicated range.

Although the present invention has been fully described by way of examples with reference to the accompanying drawings, it is to be noted that various changes and modifications are apparent to those skilled in the art. For example, the number of the indication lamps **24***a* to **24***d*, that is, the number of the light emitting diodes D9 to D12 can be varied to any desired number. Moreover, the pattern information carrying means which has been described as been constituted by cam arrangement can be constituted by electric memory device using a micro-computer in which an address circuit in the memory device may be so arranged as to produce coded signal corresponding to the selected button switch. In this case, such coded signal can be used for lighting the required light emitting diodes for the indication of the available range of the pitch. Therefore, such changes and modifications, unless they depart from the true scope of the present invention, should be construed as included therein.

What is claimed is:

1. A sewing machine having a thread carrying needle which is reciprocated in an axial direction thereof and is jogged in a lateral direction, a cloth advancing mechanism for advancing a cloth in a direction perpendicular to the lateral direction at a predetermined pitch after every one stitch for forming a predetermined pattern of stitches, said sewing machine comprising:
- a plurality of individual pattern information carrying means each provided for controlling the lateral movement of the thread carrying needle;
- means for selecting any one of said pattern information carrying means;
- means for producing a selected signal having a value indicative of the selected pattern information carrying means;
- means for adjusting the pitch of cloth advance;
- a plurality of illumination elements aligned along the pitch adjusting means; and
- circuit means connected between the signal producing means and the illumination elements for lighting at least one predetermined illumination element upon receipt of the selected signal, said lighted illumination element indicating an available range of the pitch for the selected pattern information carrying means;
- some of the possible values of said selection signal lighting more than one of said predetermined illumination elements.

2. A sewing machine as claimed in claim 1, wherein said individual pattern information carrying means is a cam.

3. A sewing machine as claimed in claim 2, wherein said signal producing means includes a decoder element having a plurality of output terminals, the number of said output terminals corresponding to the number of the cams, for producing a signal from a terminal corresponding to the selected cam.

4. A sewing machine as claimed in claim 1, wherein said illumination elements are light emitting diodes.

5. A sewing machine as claimed in claim 1, wherein said pitch adjusting means is presented in a form of dial.

6. A sewing machine as claimed in claim 5, wherein said plurality of illumination elements are aligned in a form of arc concentrically around the dial.

7. The sewing machine of claim 3, wherein said circuit means comprises an M×N diode switching matrix, said matrix having M row lines corresponding to the number of said illumination elements and N column lines corresponding to the number of said individual pattern information carrying means, and a plurality of diodes, each of said plurality of diodes connecting a column line corresponding to an individual pattern to one of said illumination elements which corresponds to an available range of the pitch for that individual pattern.

8. A sewing machine having a thread carrying needle which is reciprocated in an axial direction thereof and is jogged in a lateral direction, a cloth advancing mechanism for advancing a cloth in a direction perpendicular to the lateral direction at a predetermined pitch after every one stitch sewing machine comprising:
- a plurality of individual pattern information carrying means each provided for controlling the lateral movement of the thread carrying needle;
- means for selecting any one of said pattern information carrying means;
- means for producing a selected signal having a value indicative of the selected pattern information carrying means;
- means for adjusting the pitch of cloth advance;
- a plurality of illumination elements aligned along the pitch adjusting means; and
- circuit means connected between the signal producing means and the illumination elements for lighting at least one predetermined illumination element upon receipt of the selected signal, said circuit means including an M×N diode switching matrix, said matrix having M row lines corresponding to the number of said illumination elements and N column lines corresponding to the number of said individual pattern information carrying means, and a plurality of diodes, each of said plurality of diodes connecting a column line corresponding to an individual pattern to one of said illumination elements which corresponds to an available range of the pitch for that individual pattern said illumination elements indicating an available range of the pitch for the selected pattern information carrying means.

9. A sewing machine having a thread carrying needle which is reciprocated in an axial direction thereof and is jogged in a lateral direction, a cloth advancing mechanism for advancing a cloth in a direction perpendicular to the lateral direction at a predetermined pitch after every one stitch for forming a predetermined pattern of stitches, said sewing machine comprising:
- a plurality of stitch pattern cams, each providing information indicative of a particular stitch pattern;
- a cam follower for reading the stitch pattern information from said cam;
- means for selecting a desired cam from said plurality of stitch pattern cams;
- motor driving means for moving said means for selecting to move said cam follower to the desired cam;
- means for sensing the position of said cam follower and producing a desired pattern output signal representative of this position; and
- means responsive to said desired pattern output signal for indicating the available range of pitch for said desired cam.

10. The sewing machine of claim 9, further comprising:
- means for inhibiting the operation of said means for indicating to prevent the display of information relating to the available range of pitch of said desired cam.

11. The sewing machine of claim 9, wherein said means for indicating provides a range of pitch for said desired cam independently from the relative location of said desired cam in relation to the others of said plurality of stitch pattern cams.

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